

Abstract

The present invention aims to provide a solid proton exchange membrane and a membrane-electrode assembly (MEA) for use in fabricating an inexpensive and efficient proton exchange fuel cell (PEFC) which enables direct use of an organic fuel without a reformer and use of hydrogen gas. In particular, the invention provides an electrochemical cell including a solid electrolyte membrane made of one or plural kinds of layered silicate minerals or the intercalation compounds. The layered silicate minerals can be easily fabricated into a solid electrolyte membrane which shows a "molecular sieve effect" on the target fuel if the density and impregnated liquid contents are properly controlled. A composite membrane in which a catalyst is directly supported is also fabricated easily. Since the layered silicate mineral is an inorganic material, the fuel cell can be operated at high temperature. Thus, the catalyst can be selected from a wide range of candidate materials. The layered silicate minerals are abundant in nature and inexpensive. The use of the layered silicate mineral allows to fabricate an inexpensive direct methanol fuel cell (DMFC) and a realistic direct ethanol fuel cell (DEFC). Furthermore, an energy-efficient PEFC using hydrogen gas can also be produced therefrom.